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ABSTRACT

A progress report on a research project directed toward facilitating deeper understanding of economic concepts at the university level is presented. The purposes of the project are to explore phenomena conceptualization and to investigate why some students are more successful at a learning task than other students. In the analysis of a microeconomics course, student comprehension of economic concepts and principles was assessed. Students were interviewed on basic economic questions before, during, and after participating in the course. Findings were evaluated over three semesters, with an experimental course in microeconomics instituted during the fourth semester. Characteristic ways in which students understood and misunderstood basic concepts such as opportunity cost, production and cost functions, and utility and costs are described. A preliminary conclusion is that student understanding of basic concepts would increase if learning was described in terms of the structural aspects of the learning process such as forgetting, remembering, problem solving, or adhering to a specific teaching method. (Author/DB)

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INVESTIGATIONS INTO THE LEARNING AND TEACHING
OF BASIC CONCEPTS IN ECONOMICS (1)

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INVESTIGATIONS INTO THE LEARNING AND TEACHING
OF BASIC CONCEPTS IN ECONOMICS

- A RESEARCH PROJECT ON HIGHER EDUCATION

Paper presented at the Congress of the European Association for Research and Development in Higher Education, August 30 - September 3, 1976, Louvain la Neuve, Belgium.

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SWEDEN

Our intention is to present a progress report from a research project aimed at finding out ways of facilitating a deeper understanding of certain concepts in Economics at University level.[1] The project can be seen as a continuation of previous research activities, especially within a project entitled "Study skills and learning", which was carried out during the years 1970-74 (see for instance Svensson's (1976) work with the same title). The conclusions from this project concerned qualitative differences in learning.

Some remarks on learning

One type of differences concerns the process of learning. We found that when reading a text, students differed as to what they had as the object of focal attention. Some of them were orientated toward the text in itself, others tried to achieve a deeper understanding; their attention was focussed on the content of the text.

The difference between students in the focus of attention covaried with a difference between a passive and an active attitude to learning, which could be characterized in terms of two different conceptions of learning. According to the first conception, learning is something that happens to you and according to the second conception learning is something that you do. Our intention with this dichotomy was to provide a description of differences as to how people set about learning, i.e. differences which can be seen as lying behind the differences in the outcome of learning. The latter can also be considered from a qualitative point of view.

Variation in the outcome of learning is as a rule described in terms of how much has been learned. Such a model of description is, however, neutral - if not blind - to the content of learning. Reasonably, we get closer to the heart of the matter if we describe differences in the outcome of learning in terms of what has been learned. This may again refer to two different aspects. First, there may appear differences as to which parts of a text people remember and

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1) The project was started in 1974 and it is planned to last for four years. This research is financed by the R and D unit of the Office of the Chancellor of Swedish Universities.

which questions concerning the content of that text they can answer. This brings to mind, of course, the previously mentioned quantitative description of the outcome of learning. The only difference is that, instead of summerizing points on the whole of the text as regards questions for each individual, we preserve the entire pattern of answers. In each case, however, there is a tacit assumption concering the homogenity of knowledge (and understanding); either you know a certain principle or you do not. This assumption is obviously false. People conceptualize the phenomena, principles etc. they are told about in the text they read, in various ways. These conceptions represent qualitative differences in the way people understand or misunderstand the actual phenomena and principles. The variation thus obtained, probably gives clues to the conceptual prerequisites of the comprehension of those phenomena and principles and the conception which exists in a certain individual will probably reveal the specific conceptual prerequisites (if any) which he lacks. As far as a single individual is concerned, the comprehension of a certain concept, phenomenon or principle which appears in or can be thought to underly a text which he is reading can thus be seen as a function of his conceptual prerequisites on the one hand, and of what he had as the object of his focal attention during reading, on the other.

We can consider the level on which people approach a text (i.e. what they have as the object of their focal attention) as an individual characteristic with a hypothetically high generalizability over situations (the notion of generalizability in this respect has in fact been given considerable support by Svensson in his above mentioned report). A possible next step is then to investigate the extent to which we can make people orientate themselves towards a deeper understanding of what they read or hear. There is some evidence that rather diffuse and general modes of influence towards comprehension-orientation may have weak postivite effects (Marton, 1974; Dahlgren, 1975). On the other hand, attempts with the same goal, when explicit means of control were used, did not turn out very well. In these cases, subjects were told in one way or another what kind of questions they were supposed to answer either during or after read-

ing. The basis for these attempts was the observation that those who orientate themselves toward a deeper understanding of a text can be characterized in terms of what kind of questions they are looking for an answer to. Obviously what they are trying "to get out" of a written (or spoken) discourse is answer to: "What is the whole thing about?" "What is the message?" "How are the different parts related to each other and to the main point(s) of the discourse?" When we put this kind of question to people before they read the text, and especially when this kind of question is asked several times during the learning session, people seem to develop a specific strategy for circumventing both the text and the intention of the experimenter. They try to pick up information in order to answer the questions, not by working through the text (which was meant by the experimenter), but by paying attention in a selective way only to those parts of the text which they consider as relevant in relation to the subjectively (and erroneously) experienced demands. We call this detrimental strategy "technification" and its mechanisms and effects have been demonstrated in various contexts (Marton, 1976; Dahlgren, 1975 and Säljö, 1975).

One of our conclusions was thus that there are fundamental differences in how people set about learning. We have characterized this dichotomy in terms of whether people have the discourse in itself, or rather what the discourse is about, as the object of focal attention when taking part in it. We have pointed out that this dichotomy is closely related to a difference between a passive and an active conception of learning (to what extent one considers oneself as the agent of learning, i.e. he who does it). Svensson (1976), working withing the same research group and partly also with the same method, found that differences in the learning process could best be characterized in terms of a distinction between an atomistic and a holistic approach.

Max Wertheimer (1945) contrasted "productive thinking" with "learning by drill ... by memorizing, by blind trial and error" (p 246) and his student Katona (1940) studied different effects of "organizing and memorizing". Goldman (1972) makes a distinction between "logical" and "concrete-mnemonic", Biggs (1976) between

"reproductive" and "transformational" strategies and Pask and Scott (1972) speak of "holists" and "serialists" when they consider individual differences in the process of learning. Whether these various dichotomies refer to different phenomena or to different aspects of the same phenomenon is an open question. We think, however, that the second alternative is true. All the dichotomies seem, more or less, to have to do with two different conceptions of learning, namely learning as a transmission of unrelated "bits of knowledge" on the one hand,and learning as a change in the conception of same aspect of the surrounding world on the other.

If we want to improve the way people set about learning we should not adopt any general kind of training, independently of the content of the academic subject. Learning strategy or attitude to learning is not an additional component of studying apart from the knowledge of the subject matter, rather general learning skills (if there are any) are aspects of the work with the concrete content of the subject.

Some remarks on teaching

Just as general learning skills are considered by us as aspects of the learning of certain specific contents, general principles of teaching (if there are any) should be viewed as aspects of the teaching of certain specific contents. We think that there is a very unhealthy lack of balance between the attention paid to questions formulated in general terms and the attention paid to the actual content of teaching. General properties should, in our opinion, be discussed and investigated in relation to certain specific contents. This is, in fact, one of the major aims of the research project reported on in this context.

There should, of course, be some guiding lines before starting work on the specific content. Some views of this kind are discussed and exemplified below.

1. The comprehension of a certain concept (principle, phenomenon) can be seen as a function of the way in which it appears in the actual context, what the individual has as the object of his attention at the time and which conceptual prerequisites he possesses. This latter view implies that the conception of something is, to a certain extent, a function of the conception of something else. Learning can, from a certain point of view, be considered as a process in which the unlimited variation of the surrounding world is interpreted in terms of a limited number of basic concepts or structures. If this conceptualization is correct, it seems reasonable that in order to improve learning we should concentrate our efforts on such basic concepts or structures. "Basic", however, does not neccessarily refer to what is basic from the point of view of the academic discipline. A thorough analysis of the content of the actual course is naturally the given starting-point. Such an analysis should reasonably result in a set of central concepts and principles. What is basic from the point of view of learning is, however, a psychological question. The most fundamental assumptions of an academic subject are as a rule taken for granted and thus they are of a tacit kind. The most basic conceptual prerequisites of understanding are in fact not in the academic subject but rather "below" it. Consequently the best way of discovering them is to analyze the way in which students think about the content of the subject.

The present project is closely related to a study carried out by Dahlgren (1975). In this, subjects read two chapters from a Swedish edition of Paul Samuelson's book Economics (Samuelson, 1969)[2], in an experimental setting. As far as the experiment was concerned, the main interest was concentrated on the second chapter "Central problems of every economic society". In the analysis of the content two constructs were found underlying the chapter: the production possibility frontier and the law of diminishing returns. The former "... depicts society's menu of choices" (ibid p 21), e.g. between military and civilian production (see fig. 1).

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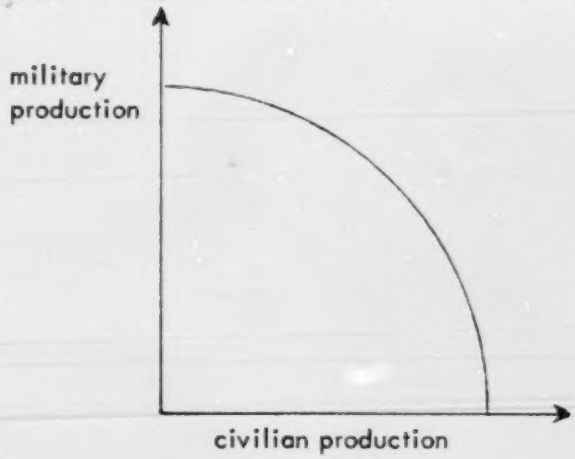
2)The quotations given below are, however, taken from a later English edition (Samuelson, 1973).



Figrure 1.
The production possibility frontier

When the productive resources are fully utilized the actual country is located on the frontier; in other cases it is located within the area delimited by the frontier and the both coordinate axes. The distance to the frontier corresponds to the degree of unemployment of the productive resources. The bowed-out or concave curvature depicts the fact that "... in order to get equal extra amounts of one goods, society must sacrify ever increasing amounts of the other goods" (op.cit. 29). Several difficulties are involved in the comprehension of the concept of production possibility frontier. One must, for instance, realize that both the employment and the allocation of productive resources may vary. Furthermore, the exchange relation between two types of goods is second order in character: there is an increment of decrement in the production of that type of goods which we give up for a certain amount of another type of goods. An additional complication is that the production possibility frontier is a variable which can be considered as a function of previous allocations of productive resources between consumption and investment.

The law of diminishing returns states that "An increase in some inputs relative to other fixed inputs will ... cause total input to increase, but ... the extra output resulting from the same additions of extra inputs is likely to become less and less" (Op.cit. p. 27). In table 1 the fixed inputs refers to land areal and the variable input to labour.

Table 1

Law of diminishing returns (after Samuelson, 1973, p 27)

Man-years of labour	Total product (bushels)
0	0
1	2.000
2	3.000
3	3.500
4	3.800
5	3.900

Again, the main difficulty in grasping the principle lies in its second order character (it involves "decrement of increment", i.e. "change of change"). When further analysis of the variation in the underlying conceptions was carried out the following conclusion was made:

> "...(a) distinction, considered to be fundamental, is between what we may call the static and dynamic conception of allocation/distribution (or scarcity of what is to be allocated/distributed). The former implies a constant quantity to be divided; the more of one commodity, the less of another. In the latter case, the attributes of allocation/distribution (e.g. the quantity to be divided, rate of exchange etc) are themselves subject to change. In other words, scarcity refers in the first case to the output of production, i.e. goods, and in the second, to production factors.
>
> Apparantly related to this distinction is the difference between thinking in terms of the rather abstract concept of productive resources and the more concrete concept of production (or output, i.e. goods.)" (Marton and Dahlgren, 1976)

Recently, an editorial note appeared in a Swedish newspaper "concerning the economic problems of Great-Britain" (Göteborgs-Posten, 1976). We felt that there was a certain similarity between the static conception of the allocation of resources we found in a large proportion of the students who participated in our investigation and the static conception of the course of economical events which Ralf Dahrendorf, according to the editorial note found to underlie the British difficulties:

> "... a long-staying guest in England - Professor Ralf Dahrendorf - claims that the British economy made no progress, because of an error of judgement and because people do not dare to take fresh initiatives. It is dangerous to see society as a football match which can only be won at the expense of others, says the newly-appointed Vice-Chancellor of the London School of Economics. Dahrendorf has a more dynamic view of society with him from Germany ... Strangely enough, he has borrowed the terms he uses from a sport and from Sweden: 'Society is more like the famous Vasa Ski Race where many participate, a few reach the finishing line before the others and are rewarded for it but still, everybody finishes the race.'"

2. The second principle that we should like to discuss has to do with the view that the basic concepts, structures and principles should, initially, be represented in a fairly clear form. In this way we can proceed from the simple to the complex and yet have the whole as the starting point. The acquisition of a certain basic structure represents an obvious qualitative difference as compared to not possessing that structure. The same structure can, however, appear in an unlimited number of different situations and the attributes of these situations can be of decisive importance as to whether one thinks according to the actual structure or not. This means that in addition to the structural difficulty there is difficulty of a quantitative nature which has to do with the number and the complexity of irrelevant factors which are superimposed on the basic structure. Discerning the structure of the situation may, in fact, often represent the major difficulty.

Some findings made by Abramowitz (1975) can serve as an illustration. In her investigation the subjects, who were seventh grade students (i.e. twelve to thirteen years old), had to solve problems based on proportional reasoning. In each task the subject was shown "... a stick figure (Mr X) measured by two sets of different colored loops. The subject was asked how many loops of each color it took to measure Mr X." After this, the subject was shown "... a different sized stick figure (MrY) measured by only one set of colored loops. The subject was asked how many loops of the other color it would take to measure Mr Y and to explain how he/she arrived at that answer." The solution of the task thus requires the realization of the fact that the relationship between the number of loops of the dirrerent colors is the same, independently of the object measured. Such an understanding is of a structural character, i.e. if could be

supposed to be present or absent irrespectively of the actual figures used in the task. This was, however, not found to be the case. Correct proportional reasoning was, for instance, three times as frequent when the unknown was an integer (e.g. $4/6 = 14/x$) as when it was not (e.g. $5/7 = 8/x$).

We think that the relative instability of a certain structure is more a rule than an exception. In the initial phase of the acquisition of a concept or a principle the level of difficulty can preferably be kept down by reducing the number and complexity of "irrelevant" factors. Greater stability and applicability can be achieved by successively increasing level of quantitative difficulty and the variation in "irrelevant" factors. By means of such variation we may transcend the narrow context of the instructional setting and approach the outside-school reality. We think that one of the major tasks of teaching is precisely the facilitation of the realization of the fact that an unlimited range of situations can be interpreted in terms of a limited number of concepts and principles.

3. The third view concerns qualitative differences in the conceptions which appear in teaching. We have previously discussed qualitative differences in the outcome of learning which appear when different people confront a certain concept, phenomenon or principle in the same form. In most cases, it has been possible to arrange hierarchically conceptions that have arisen under such conditions (Marton, 1975; Dahlgren, 1975; Säljö, 1975). This implies that the different conceptions vary in proximity to the intended meaning of the concept or principle. In other words these conceptions are more or less correct. Obviously, however, these findings can not be generalized in other cases of qualitative differences. Different conceptions may represent alternative, possible interpretations which simply represent different points of view. Which conception appears in the instructional setting can, however, be of decisive importance as regards the students' comprehension of the actual concept or principle.

As an example, we should like to refer to an alternative explanation of the concept of function in mathematics. According to Greger (1971) a function can be seen as a machine with an input channel and an output channel :

1. It is determined exactly which elements may be fed into each 'machine'. These elements are called the operands (or argument) of the 'machine'. The set of operands of a 'machine' is called the set of definition of the 'machine'.

2. A definite 'mechanism' is triggered for every operand that is fed into the 'machine', i.e. the operand triggers a fully determined and well-defined sequence of actions or operations by the 'machine'. It is then said that the 'machine' operates on the operand.

3. When the 'machine' operates, it transforms ('changes', 'reproduces', 'transfers') the operand into a completely definite and unequivocal 'end-product' which we call the transform (result, value, image) and which is fed into the output channel. The amount of transforms is called the range of the 'machine'.
(ibid. p. 149)

As far as functions in usual mathematical contexts are concerned the inputs as well as the outputs are numbers. The above conception of function, however, also applies to e.g. a machine for paper-folding.

> "A machine for paper-folding can be seen as a function if it, for example, functions in the following way: the operands, which consist of A4 sheets of paper, are fed into the machine; the machine operates, i.e. it folds each incoming sheet of paper so that the two ends are touching each other; the result, the folded sheet of paper, is fed out. In this example, the operand happens to be expended when it is transformed into the result. This is, however, completely irrelevant."
> (op.cit. p. 150).

This conception of function is very concrete and very abstract at the same time. We cannot refer to any systematic investigation of its effects on students' comprehension. Our intention was only to provide an example of a qualitatively different presentation of a basic concept.

4. In agreeing with what has been said previously we consider the student as "the agent of learning", he constructs meaning (knowledge, understanding) so to say. But, what are the conditions for evolving of new concepts and for the learning of something new in the sense of reinterpreting some aspect of reality? The basic mechanism, in our opinion, is some kind of cognitive conflict either in the form of a gap between a desired state (to know) and a real state (to be ignorant) or in the form of some conceptions which are incompatible. It is of course fairly common for people to have contradicting conceptions. One of the theachers'

most important tasks is, however, to make the students pay attention to the implications of their various conceptions.

One of our colleagues, Leif Lybeck, is at present running a research project concerning concept formation in science and mathematics in secondary schools. In his efforts to find out how the subjective meaning of the concept of pressure varies, he asked a number of subjects to explain how the "Cartesian diver" (see fig. 2) works.

Figure 2.
The Cartesian diver

This is a popular object for demonstration among physics teachers. The "diver" is a hollow glass figure filled with air and with a hole in the bottom of it. It floats in a container filled with water which is sealed with a rubber stopper. When the stopper is depressed the air-pressure inside the "diver" rises as a result of water forcing its way in through the hole and the "diver" sinks to the bottom. When the pressure on the stopper ceases, the air in the "diver" resumes its original volume and "he" once more rises toward the surface. The majority of the subjects (they were both over and under the age level with which

the main study will be concerned (about 16 years old)), did not immediately understand the connection. In actual fact, the interview is in itself a learning process that can be described in terms of a number of qualitively differing conceptions of the same phenomenon. This depends partly on the fact that the interviewer is, contrary to customary practice, not passive but instead tries by means of questions to help his subjects attain an understanding as complete as possible. Several subjects claimed, for example, that there is less air in the "diver" when the stopper is depressed. "Well, where does the air go, then?" wonders the interviewer. If it is realized that when air passes through water it takes the form of visible air bubbles, then a conflict situation arises between "there is less air now than before" and "none of the air has disappeared". This conflict situation is solved by the apperance (or reappearance) of the concept of density during the actual experiment: "The air gets squeezed" the subjects say.

Some remarks on research

We have previously spelled out our conviction that much more stress should be placed on the content of learning. We do not argue for the inclusion of the classification of content (e.g. argumentative-factual prose passage) in the description of experiments in learning as an additional parameter. Rather, we think learning should be described in terms of the structural aspects of its content. The problem thus concerns what we consider to be the proper level of inquiry, what we think to be the proper data of research on learning(at least within the field of educational psychology). Furthermore, this concerns the way in which we have structured our thinking about learning. Problems are described in terms of general properties of the process of learning, retaining, forgetting, remembering, problem solving or in terms of general differences between individuals, groups or teaching methods. To what extent descriptions of this kind can be generalized over various contents is, of course, to a certain extent an empirical question. We wish only argue that there is both a need for and a lack of knowledge about how people conceptualize various phenomena in the surrounding world; what the main difference between understanding and not understanding consists of and which differences in the conception of some

more fundamental aspects of reality that the differences in the comprehension of a certain phenomenon are connected with. It is a question of centering the problem in a different way. Instead of asking, for instance, whether a certain method of instruction facilitates learning in a certain kind of student, we should like to know, for example, in which different ways proportionality is conceptualized, how the understanding of the structure "times as much as" is related to the understanding of proportionality, and how the comprehension of the kinetic theory of gas is related to the comprehension of proportionality.

The description of qualitative differences in the conception of the surrounding world can be found most frequently in developmental psychology. The differences between conceptions of a certain phenomenon may, however, represent entirely different scources of variation, such as variation within a single individual during his development, during a learning experience or during the process of making a scientific discovery. The same variation may, however, represent differences between individuals on the same age and educational level, between cultures or between stages in the history of science.

This means a centering of interest on the structural properties of certain contents of thinking. Research based on this point of view should consist partly of collecting information from different sources concerning various conceptions of certain phenomena and partly of looking for relationships on the basis of content i.e. questioning how the various conceptions of different phenomena are related to each other.

When it comes to the educational setting, this implies, of course, primarily studying the variation in the students' conception of central parts of the content of the course and investigating the relationship between the variation obtained and conceptual prerequisites.

The general outline of the project

The aim of the actual project is to arrive at a basis for facilitation of comprehension of the content of the course in Microeconomics. The project concerns

the introductory course in Economics at university level, in particular the course in Microeconomics which lasts for eight weeks during the first term. The first step in the work within the project was a thorough analysis of the content of the course, carried out by a subject matter specialist and an educational researcher who had studied Economics. A number of basic concepts and principles were arrived at and problems for assessing the students' comprehension of these were constructed. These problems, seven in number, were presented to 20 students two weeks after the course examination during individual, oral interviews. (This took place during the first term of the project.) Each interview was taped and later transcribed. The aim of the analyses of these interviews was partly to arrive at a description of the variation obtained and partly to try to attribute the misunderstandings discovered to erroneous conceptions of more fundamental concepts and structures.

During the project's second term, two groups of beginners, each consisting of 15 students, were formed randomly. One of the groups was interviewed at the beginning of the term, (i.e. before the course started); at the end of the term, i.e. after the course had been completed, both groups were given a similar interview. In the interviews, 10 so-called everyday economic questions were asked, i.e. questions which, as regards content, were taken from the students' everyday life and brought basic economic concepts to the fore. The aim was to investigate the extent to which studies in Economics influence the students' conception of that part of the outside world covered by these studies.

The third term was devoted to analyses of what the students had said during the interviews. During the recently completed fourth term an experimental course in Microeconomics was included. In this course, an attempt was made, with the help of what had previously been learnt of the students' conceptions and misconceptions, to make the new students attain a deeper understanding of the phenomena, concepts and principles dealt with during the course.

The experiment has been evaluated by means of results of the course examination, but above all by means of individual interviews aimed at assessing the students' comprehension of the content of the course on a deeper level. Furthermore, the long-term effects of the course will be investigated on a later occasion.

Students' understandings of some basic concepts in economics

In this context we wish only to illustrate the kind of observations we are trying to arrive at in order to improve our understanding of the ways students understand or misunderstand certain basic concepts and principles in Economics.

We have chosen to describe briefly some characteristic ways of thinking which came to expression in connection with three of the above mentioned seven questions used in interviews carried out during the first term of the project.

The first of these three questions was formulated:

"What is meant by the concept 'opportunity cost'?"

This concept is frequently used in economic theory. Opportunity cost is fundamentally a relative cost concept. Consider a situation where a person has at his disposal a sum of money. He faces the alternatives, of investing the money in his own firm or puting it into a bank account. The opportunity cost of the investment alternative is the interest he would get from the bank while the opportunity cost of the bank-saving is the profit he would get from investing the money in the firm. The concept of opportunity cost is applicable in a number of situations and is in no respect restricted to situations like the one described above.

The answers to this question found in our group fall into two distinct categories.

A. Opportunity cost is conceptualized as the cost for an alternative expressed in terms of the outcome of the alternative that is not chosen.

B. Opportunity cost is conceptualized as the cost of choosing a certain alternative in order to achieve a specific goal.

The main difference between the two categories is that the A-variant implies a relative cost concept while the B-variant implies an absolute. In the A-cate-

gory the mean is fixed and differences occur as regards the output of different alternative ways of using the resources. The B-variant reveals the conception that the goal is fixed and that what varies are the costs of different ways of reaching the goal.

The second question was asked in order to obtain a better grasp of the students' conception of the connection between the production function and a number of cost functions, such as average total cost (ATC), average variable cost (AVC) and marginal cost (MC).

Three different production functions illustrated in figure 3 were presented.

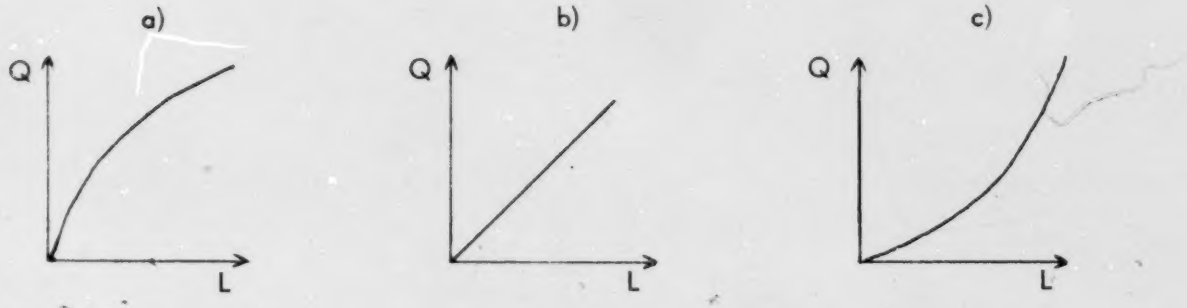


Figure 3.
Three different production functions

Two specific questions were then put to the subject:

> "Three production functions are illustrated. The total output, Q, is produced by means of one single production factor, L. The cost for one unit of L is constant.
>
> a) The production techniques differ with regard to the correlation between increments of the production factor and increments of the total output. How?
>
> b) What will corresponding cost functions look like? Describe ATC, AVC and MC."

A correct answer to the a-part of the question should contain, in the case of the a-diagram, the basic structure that "the increment of production that follows an increment of production factor L is not constant but will be smaller".

In the b-diagram "the relationship between an increment in quantity produced and an increment of the production factor L is constant" and in the c-diagram "the increment of quantity produced if the quantity of the production factor L is increased, will gradually increase".

In the language of economics, the a-diagram is an example of "decreasing returns to scale" and the c-figure is an illustration of "increasing returns to scale".

(In reality, the production function is a composite of all three functions in the order c - b - a i.e. due to large scale advantages there is first increasing returns to scale, later an inflexion point and finally decreasing returns to scale.)

In the text book, all three production functions are illustrated and explained. The first part of the question usually did not cause any greater difficulties to the subjects, even if we accidently made the observation that the meaning of the word "constant" (that was often used to characterize the b-function) was not completely understood by some subjects. Several subjects stated that the relation between Q and L was constant because the angle between the graph and the axes was (by accident) about 45°. Further prompting revealed that these subjects did not consider linear functions, except in this case, as depicting a constant relationship between two variables.

Several problems, however, emerged when it came to the b-part of the question. A correct answer to this question has to contain a kernel of the following type: As the production is possible by utilizing only the production factor L, ATC (average total cost) is equal to AVC (average variable cost).[3]

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3) The average total cost (ATC) is defined as the total costs (variable and fixed costs) per unit produced i.e. $ATC = \frac{\text{fixed costs + variable costs}}{\text{quantity produced.}}$

Hence, the average variable costs, $AVC = \frac{\text{variable costs}}{\text{quantity produced.}}$

The marginal cost (MC), is defined as the variable costs per unit produced i.e. is the derivative concept of the total cost, namely the cost of an additional unit produced, i.e. $MC = \frac{\Delta \text{ total costs}}{\Delta \text{ quantity produced}}$

In the a-diagram ATC and AVC will increase since in order to maintain a constant additional increment to the output, even larger additions of L is necessary (which costs more and more money). The marginal cost (MC) will also increase (for the same reason as ATC and AVC). The rate of the increment of MC will be about the same in the beginning as the ATC and AVC, as the relation between L and Q is more favourable in the beginning than at the end. In a later phase, MC will, however, increase even faster than ATC and AVC since a positive "prehistory" in the production will moderate the steepness of ATC and AVC.

Even though it was pointed out that only one production factor is involved, only very few subjects realized that ATC = AVC. The majority seemed to be heavily reliant on all the pictures they had seen in their textbooks. This is clearly indicated when several subjects tried "to remember what ATC, AVC and MC looked like". In other words, it was evident that a general strategy was to recall some kind of pictorial memory image from text book diagrams. This search for fragments of a pictorial image rather than a construction based on the determining production function given is even more obvious when the subjects are faced with the b- and c-functions. Since production functions of these kinds are very seldom discussed in text books, some slightly modified version of the solution to the first function is very often applied.

The uncomplete understanding of the word "constant" is further illuminated when the subjects try to illustrate the MC for the b-function. Even those who state that the MC is constant, very seldom make correct illustrations. The MC is instead very often drawn like diagram b in figure 3.

The error is presumably a consequence of lack of discrimination concerning when "constant" refers to a relation between two variables (like the linear production function in diagram b in figure 3) and when it refers to the value in one single variable, and should thus be illustrated by a line parallel to one of the coordinate axes.

In other words, only very few of the subjects seem to realize that, on condition that the meaning of AVC, ATC and MC is clearly understood, all the information needed in order to solve the problems in question is given by providing the slope of the production functions. The problems are thus not solved primarily by trying to remember "what the curves looked like" as many of the subjects actually do.

The thorough understanding of such basic concepts is obviously not a necessary prerequisite for passing the exam in Economics. Several subjects realized that they did not succeed very well in this question; they often made comments such as "You would probably be very surprised if I told you how well I passed the exams" or "OK, I can't cope with these questions but I nevertheless passed on the exam".

This brief and to some extent casual analysis of the answers to the question about different cost concepts clearly supports the suspicion that the part of microeconomics for which the understanding of the relation between these relatively elementary concepts is a necessary prerequisite, is not quite understood by a great part of the students, by some of them probably not at all. It may even be that the criticism of microeconomics, mainly for being totally artificial, that is raised by several students, may have its roots in the fact that these students do not understand microeconomics at all.

Also, the last of these three questions was intended to illuminate a certain aspect of the understanding of the actual concept. The correct answer follows, in fact, directly from the meaning of the concept. The question was based on the diagram in figure 4.

"How do utility and costs respectively develop according to the diagram.

a) along the indifferance curve $I - I'$
b) along the budget line $A^1 - B^1$?"

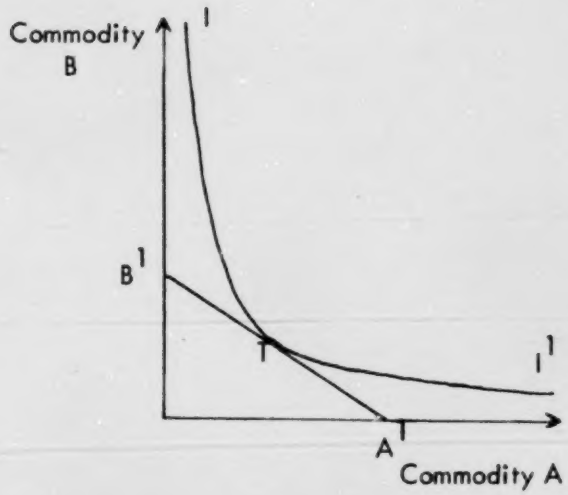

Figure 4.

Budget line and indifference curve

The diagram is an illustration of which combinations of commodity A and B yield a constant value as regards the total cost for a household (the budget line $A^1 - B^1$) and which combinations yield a constant level of satisfaction (the indifference curve I - I').

This means that the answer to (a) is that utility is constant along the curve I - I', while costs decrease in the interval I - T and increase in the interval T - I'. The answer to the b-question is that costs are constant along the line $A^1 - B^1$ and utility increases from A^1 - T and decreases from T - B^1.

One main problem that seems to create difficulties for several subjects is the normal use of a curve to illustrate a correlation between two variables. In these cases, the curve is simply an illustration of the number pairs that exist as a result of the correlation (whether this is causal or not). This also means, due to the properties of a coordinate grid, that if the curve develops from left to right, the X-coordinate increases and a movement from below and upwards means an increment of the Y-variable. This traditional use of a graph in a co-ordinate system seems to be frequently applied to the actual question. Even though it is pointed out by the definition of the indifference curve, as well as the budget line, that the value in the third/fourth and "invisible" variable

(cost/utility) is constant along the graph, the "normal" properties of a curve, as described above, are also often recognized in this case.

That this conception of the indifference curve or the budget line if frequent is indicated by the fact that several subjects state that utility decreases from $I - I'$ and/or that costs decrease from $A^1 - B^1$. In other words the opinion that something decreases when a curve has a downward slope is often too well-established to permit consideration of any alternative.

To sum up, three qualitatively different variants of answers to this question are found:

A. Costs are equal along $B^1 - A^1$. Utility increases from $B^1 - T$ and decreases from $T - A^1$. Utility is constant along $I - I'$ and costs decrease from $I - T$ and increase from $T - I'$.

B. Costs increase (or decrease) in relationship to utility along $B^1 - A^1$ and utility increases (or decreases) in relationship to costs along $I - I'$.

C. Costs (and utility) decrease from $B^1 - A^1$ (and $I - I'$).

Students' understanding of some economic phenomena of every-day-life

Economics is frequently criticized from the point of view that the subject is too abstract and has developed theoretical models that are too highly refined in order to permit the drawing of parallels to phenomena or processes in authentic everyday life situations.

As was pointed out above, during the second term of the project ten questions were asked in interviews carried out before and after the course in Economics. The questions concerned fairly familiar economical phenomena and they were formulated as much as possible in the form of concrete examples like the first one of the two questions we should like to present here.

"What would be the effects on the Swedish labour market if the UK devaluated the pound?"

The effects of studies in Economics on the apprehension of the phenomenon dealt with in this question seems to be (judging from an ocular inspection) that the interdependency in international Economics is considered.

The answers at the beginning of the course seem to lack:

a) a clear distinction between devaluation and revaluation.

Example (S no. 13) "Yes, let's see, if they devaluate the pound, it means that they can buy more from us, should mean an increment, an addition in the industry (the Swedish) in that case it will favour them (Sweden)."

b) understanding of the multilateral effects of e.g. devaluation i.e. that a devaluation is a change in a relation.

Example (S no. 15) "Yes, exactly, it would mean that the Swedish goods that are sent to England will be more expensive to the British and it should mean that the demand for Swedish goods will decrease, and in turn lead to a decrement of the production, but it depends on the part of Swedish exports that the UK buys."

The b-type errors were still frequent at the end of the term. An interesting question is, however, why they were so infrequent at the beginning of the term. It is our opinion that the b-errors are examples of a wider category of errors namely the incapability to consider a number of functions and parts in systems of interacting components. Attention is instead focussed on single functions or parts, and these are probably the ones that are best recognized by the subject.

The increasing ability to take even bigger parts of systems of interacting components into consideration, in the time perspective of one term of studies in Economics is, however, presumably not generally valid. The reason for the increment is probably just as often the effect of specific knowledge of the concept of devaluation.

Thus we get two main categories of answers to this question.

A British commodities will be cheaper in Sweden and Swedish commodities will be more expensive in Britain.

B:1 British commodities will be cheaper in Sweden.

B:2 Swedish commodities will be more expensive in Britain.

A second question from this interview was the following:

"Why does a bun cost 50 öre?"

The question was given in order to explore the subjective meaning of the concept of price. A preliminary analysis of the answers resulted in two distinct categories of meaning. Each category is further made up of two sub-categories:

A:1 The price of the bun is determined by the market price of its constituents, i.e. the price depends on the supply and demand situations for e.g. wheat, flour and transport services.

A:2 The price of the bun is determined by the supply of and demand for buns.

Example (S no. 1) "If you consider this competitive model, so to speak, that's where demand and supply are in equilibrium, that point, it's a simple answer, sort of".

B:1 The price of the bun is the sum of the "value" of its constituents.

Example (S no. 2) "Yes, there is a lot of stuff in it, it's the material that costs money, the wheat, flour and then to have it baked and wages ... and ... the costs of selling it".

B:2 The price of the bun is equal to its "value".

Example (S no. 14) "Because the producers have set a price. They have included all costs".

Thus, what distinguishes category A from category B is that A-answers indicate the conception of price as an entity that is determined by a system, (i.e. the relationship between supply and demand) while the B-answers imply the conception of price as a property of an object, like colour, size, weight etc.

Once again, this particular fixation seems to lead to a rather primitive and static apprehension of a concept that is defined in terms of the function of a system.

An interesting and at the same time discouraging fact is that B:1- and B:2-answers are found even at the end of the study course.

Several speculations about the reasons for the dominance of the property conception of price are, of course, possible. The epistemology of Economics also shows that this conception for a time was accepted as scientifically correct. Also, in the Marxian theory of labour value the property-conception of price is implied.

In popular descriptions, the property-variant is also very often given support. The price of a commodity is now and then split up in order to show how raw materials, transportation, salaries etc contribute to the total price. Even if a decription of this kind is of course not incorrect it may promote the conception of price as a tangible and given property.

Some preliminary conclusions

The study of the comprehensions of some basic concepts in microeconomics has pointed to some of the difficulties that teaching in this subject area has to cope with.

We have put what might appear as very trivial questions to our subjects. But it is our opinion that one of the main problems in higher education is that trivial questions are put all too seldom, by teachers as well as by students. In other words, teaching in higher education very often realies on assumptions about the students' knowledge in the sense of a deep enough understanding of topics dealt with in secondary (and to some extent perhaps even primary) schools, that very often prove to be over-estimations. Initially, we pointed out that several academic disciplines are generated from an "inner kernel" of a network of, as a rule, rather well-defined relations between a limited number of basic concepts and principles.

It must be an extremely essential function of teaching to secure the students' understanding of this "inner kernel". Due to quantitative overloading of the

teaching session, the teacher may be prohibited from taking the necessary measures in order to fulfill individual demands for explanation or clarification. The individual strategy for coping with the speeded-up pace during teaching sessions is probably most of all suggestive of rote-learning of algorithms presented. In other words, passing an examination is possible without understanding, if only the algorithms are correctly remembered. This is clearly indicated by the frequent use of comments such as "I don't remember exactly what it looked like" or "I can't give an answer directly, but if I was allowed to look in the book I won't need many seconds to get it".

Even if the content of the course literature is not completely understood, the student will probably be able to "learn it" anyway. But a lot of time will be required; the resulting knowledge will be a mass of logically and psychologically nonconsistent fragments, and the practical fruitfulness of the individual's study work will thus be highly questionable.

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